

FILE B

Science and Technology:

**Item Information and Scoring Guide Reference
Sheet and Quantities of Items by Type..... B-2**

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Science and Technology

**Item Information and Scoring Guide Reference Sheet
and Quantities of Items by Type**

Item Information and Scoring Guide Reference Sheet

The following pages are designed to assist you in understanding how Maine Educational Assessment (MEA) items are scored. These pages contain the text for each item accompanied by the following information.

- **MC#:** the multiple-choice item position
- **Key:** the letter of the correct answer for the multiple-choice item
- **Learning Results:** the content standard, followed by the performance indicator, that the item measured
- **CR#:** the constructed-response item position
- **Learning Results:** the content standard, followed by the performance indicator, that the item measured
- **Constructed-Response Scoring Guide:** the four-point description used to determine the score
- **Training Notes:** in-depth descriptions or particular information used to determine the score

MAINE 2002–2003

Science and Technology Grade 8

The table below shows the quantities of released items for each item type. Item information for all item types and scoring information (guides and training notes) for all constructed-response items follow.

QUANTITIES OF ITEMS BY TYPE

MC	CR
24	6

**Items with Keys, Learning Results, Scoring Guides,
Training Notes, and Student Responses**

1. Which of the following is a function of the digestive system?
 - A. providing support
 - B. producing blood cells
 - C. providing protection
 - D. getting rid of wastes

MC#: 1

Key: D

Learning Results: C-3

Cells

- C Students will understand that cells are the basic units of life. Students will be able to
3 describe the structure and function of major organs in human systems.

Boiling Points of Carbon Compounds

Name	Number of Carbon Atoms	Boiling Point
Ethane	2	-88°C
Butane	4	0°C
Hexane	6	69°C
Octane	8	126°C
Decane	10	174°C

2. Which of the following is the **best** estimate of the boiling point of heptane, a compound that contains seven carbon atoms?
- A. -40°C
 - B. 35°C
 - C. 95°C
 - D. 150°C

MC#: 2

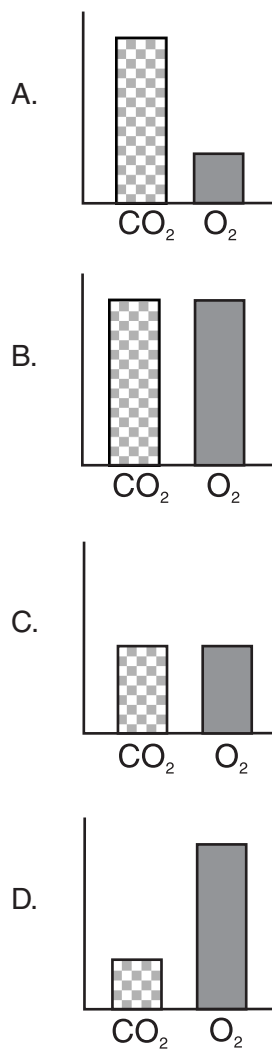
Key: C

Learning Results: L-4

Communication

- L Students will communicate effectively in the application of science and technology. Students will be able to
- 4 make and use scale drawings, maps, and three-dimensional models to represent real objects, find locations, and describe relationships.

3. Which graph shows the relative amounts of carbon dioxide and oxygen in the blood as it leaves the lungs through the pulmonary veins and travels to the heart?



MC#: 3

Key: D

Learning Results: C-3

Cells

C Students will understand that cells are the basic units of life. Students will be able to
3 describe the structure and function of major organs in human systems.

MINERALS WITH A METALLIC LUSTER

Mineral	Color	Streak	Hardness	Specific Gravity
graphite (C)	steel gray	black	1	2
galena (PbS)	silver gray	gray	2.5	7.5
chalcopyrite (CuFeS ₂)	golden yellow	greenish black	4	4.3
pyrite (FeS ₂)	brass yellow	greenish black	6	5
hematite (Fe ₂ O ₃)	steel gray	reddish brown	6	5.2
magnetite (Fe ₃ O ₄)	black	black	6	5.2

4. Which characteristic would be most useful in distinguishing a sample of hematite from the other minerals listed in the table?
- A. color
 - B. streak
 - C. hardness
 - D. specific gravity

MC#: 4

Key: B

Learning Results: J-2

Inquiry and Problem Solving

- J Students will apply inquiry and problem-solving approaches in science and technology. Students will be able to
- 2 design and conduct scientific investigations which include controlled experiments and systematic observations. Collect and analyze data, and draw conclusions fairly.

5. There are no longer dark fur arctic bears, only white fur arctic bears. Which is the **best** explanation for the lack of dark fur bears in the Arctic?
- A. The white fur bears killed off all the dark fur bears in the Arctic.
 - B. Dark fur reflected the Sun's rays. This caused the dark fur bears to die of the cold.
 - C. Dark fur bears eat fish that are not available in the Arctic environment. They, therefore, eventually died of hunger.
 - D. Dark fur bears could easily be seen in the mostly white-colored Arctic environment. They were, therefore, less successful at catching prey than white fur bears.

MC#: 5

Key: D

Learning Results: D-3

Continuity and Change

- D Students will understand the basis for all life and that all living things change over time. Students will be able to
- 3 provide examples of the concept of natural and artificial selection and its role in species changes over time.

6. To find out if radish plants grow better in store-bought soil than in her garden, Amy conducted an experiment. She grew twenty potted radish plants in store-bought soil next to a window in her house, and she compared them to twenty radish plants grown in her garden.

In which way could she improve her experiment?

- A. by growing both groups of plants in the same place
- B. by using fewer plants to be better able to make comparisons
- C. by growing radishes in the garden but tomatoes in the store-bought soil
- D. by adding store-bought soil on top of the garden soil

MC#: 6

Key: A

Learning Results: K-1

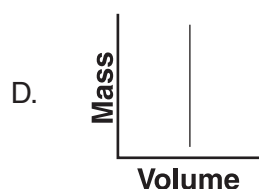
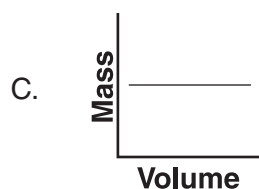
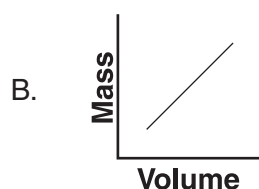
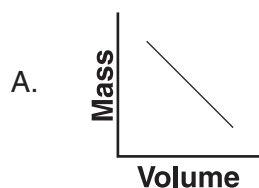
Scientific Reasoning

K Students will learn to formulate and justify ideas and to make informed decisions. Students will be able to
1 examine the ways people form generalizations.

Three Mineral Samples

Mineral Sample	Mass (g)	Volume (cm ³)
1	30	10
2	60	20
3	90	30

7. The table shows the mass and volume of three samples of the same mineral. Which graph **best** represents the relationship between mass and volume?



MC#: 7

Key: B

Learning Results: L-4

Communication

- L Students will communicate effectively in the application of science and technology. Students will be able to
 4 make and use scale drawings, maps, and three-dimensional models to represent real objects, find locations, and describe relationships.

8. A giraffe's long neck is an example of
- A. selective breeding.
 - B. behavioral adaptation.
 - C. artificial selection.
 - D. structural adaptation.

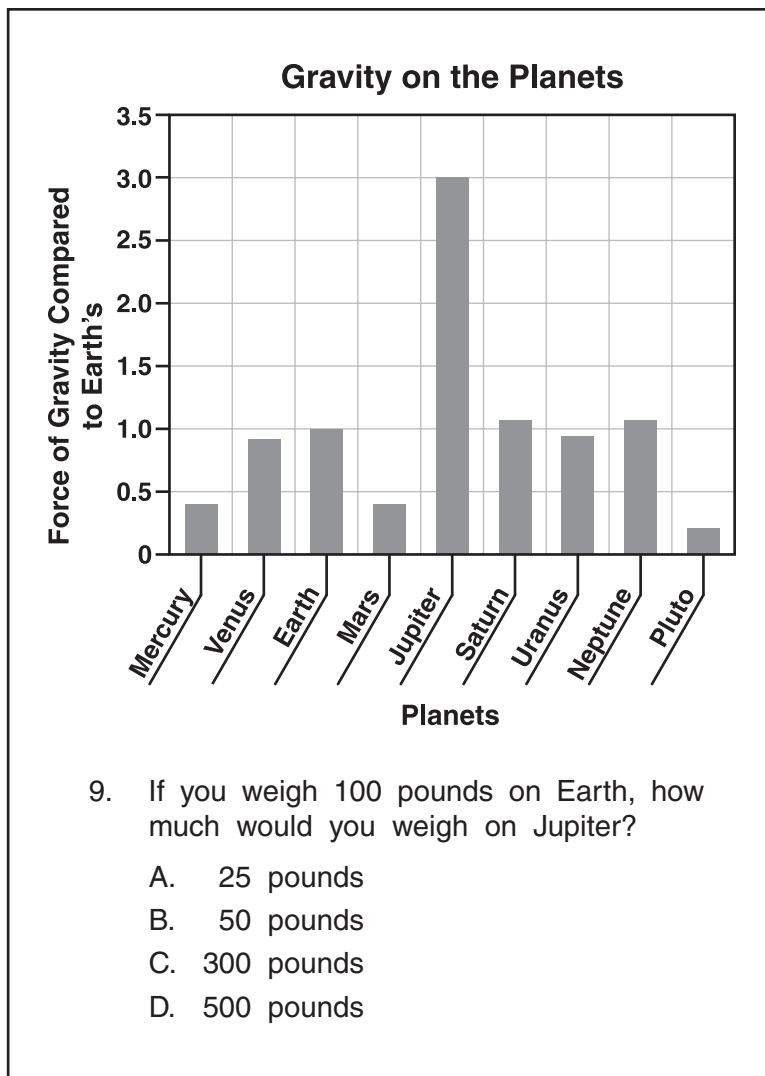
MC#: 8

Key: D

Learning Results: A-3

Classifying Life Forms

- A Students will understand that there are similarities within the diversity of all living things. Students will be able to
- 3 describe some structural and behavioral adaptations that allow organisms to survive in a changing environment.



MC#: 9

Key: C

Learning Results: L-4

Communication

- L Students will communicate effectively in the application of science and technology. Students will be able to
4 make and use scale drawings, maps, and three-dimensional models to represent real objects, find locations, and describe relationships.

Periodic Table of the Elements

1 H 1.008																	2 He 4.003
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.70	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (97)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.4	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.30
55 Cs 132.91	56 Ba 137.33	57 *La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.2	77 Ir 192.22	78 Pt 195.09	79 Au 196.97	80 Hg 200.59	81 Tl 204.37	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.03	89 **Ac (227)	104 Unq (261)	105 Unp (262)	106 Unh (263)	107 Uns (262)											

*Lanthanide Series

58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (147)	62 Sm 150.4	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
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**Actinide Series

90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (254)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)
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10. Na is to Cl as Li is to

- A. C.
- B. Al.
- C. Be.
- D. F.

MC#: 10

Key: D

Learning Results: K-9

Scientific Reasoning

K Students will learn to formulate and justify ideas and to make informed decisions. Students will be able to
9 apply analogous reasoning.

11. As a scientist was hiking up a mountain, she found fossils of seashells in some of the rocks. Which is a reasonable conclusion she can make?
- A. The rocks were formed when molten lava was cooled.
 - B. Shelled sea organisms once inhabited forested mountains.
 - C. The rocks were formed in an ocean and later uplifted when the mountain was formed.
 - D. The fossil seashells were carried up from an ocean and embedded in the rocks by strong winds.

MC#: 11

Key: C

Learning Results: D-2

Continuity and Change

- D Students will understand the basis for all life and that all living things change over time. Students will be able to
- 2 explain how scientists use fossils to prove that life forms, climate, environment, and geologic features in a certain location are not the same now as they were in the past.

12. Which of the following would cause a long-term (lasting thousands of years) change to Earth?
- A. spring flooding along the Saint John River
 - B. a hurricane coming north from the banks of the Carolinas
 - C. a volcano erupting such as Mount Pinatubo in the Philippines
 - D. tornadoes spawned from cold and warm air clashing

MC#: 12

Key: C

Learning Results: F-4

The Earth

F Students will gain knowledge about the earth and the processes that change it. Students will be able to
4 describe factors that can cause short-term and long-term changes to the earth.

13. By observing the characteristics of the Sun, people can learn more about
- A. stars.
 - B. comets.
 - C. distant planets.
 - D. the Moon.

MC#: 13

Key: A

Learning Results: G-1

The Universe

- G Students will gain knowledge about the universe and how humans have learned about it, and about the principles upon which it operates. Students will be able to
- 1 compare past and present knowledge about characteristics of stars (e.g., composition, location, life-cycles) and explain how people have learned about them.

Height of the ball when dropped	Height the ball bounces
1 foot	4 inches
2 feet	9 inches
3 feet	15 inches
4 feet	21 inches
5 feet	?

14. Yolanda dropped a ball from a height of one foot above the ground. She measured how high it bounced and recorded the data in the table above. She then dropped the ball from other heights, measured how high the ball bounced, and recorded these data in the table. The table contains all of the data that Yolanda collected.

Based on the data in the table, about how high will the ball bounce when Yolanda drops it from a height of 5 feet?

- A. about 19 inches
- B. about 27 inches
- C. about 33 inches
- D. about 39 inches

MC#: 14

Key: B

Learning Results: K-1

Scientific Reasoning

K Students will learn to formulate and justify ideas and to make informed decisions. Students will be able to
1 examine the ways people form generalizations.

15. The color of a person's eyes is determined before birth. Which statement is true?
- A. Eye color genes are transferred to offspring from male parents only.
 - B. Eye color is determined through the asexual reproduction of bacteria.
 - C. Eye color is determined by a mutation in the genetic code during fertilization.
 - D. Eye color is transferred to offspring from parents on chromosomes that contain genes for that trait.

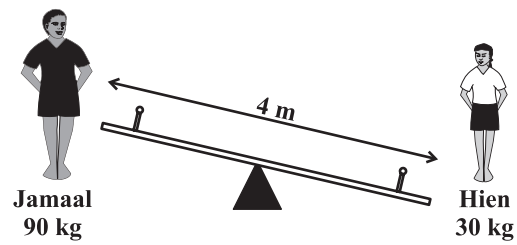
MC#: 15

Key: D

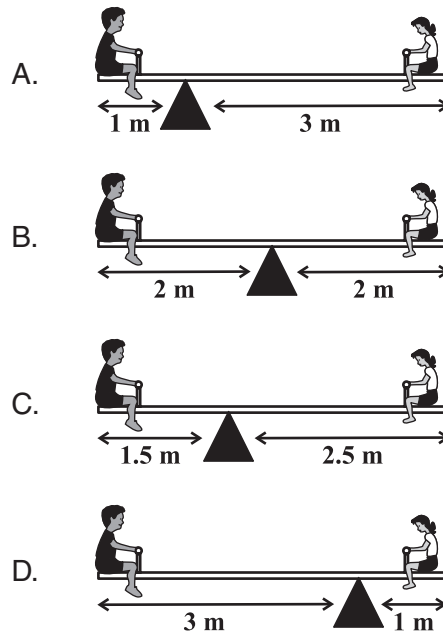
Learning Results: D-4

Continuity and Change

- D Students will understand the basis for all life and that all living things change over time. Students will be able to
- 4 compare how sexually and asexually reproducing species transfer genetic information to offspring.



16. Jamaal and Hien want to use the teeter-totter. Where will Jamaal and Hien need to place the teeter-totter so that Hien can lift Jamaal?



MC#: 16

Key: A

Learning Results: I-3

Motion

- I Students will understand the motion of objects and how forces can change that motion. Students will be able to
- 3 describe and quantify the ways machines can provide mechanical advantages in producing motion.

17. A solid chunk of iron was left outside on a black-topped driveway on a very hot, sunny day. By mid-afternoon the chunk of iron will be
- A. a little smaller than before.
 - B. a little larger than before.
 - C. much smaller than before.
 - D. much larger than before.

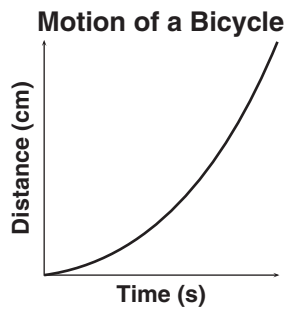
MC#: 17

Key: B

Learning Results: H-6

Energy

H Students will understand concepts of energy. Students will be able to
6 describe how energy put into or taken out of a system can cause changes in the motion of particles in matter.



18. The best description for the motion of a bicycle in the above graph is that the bicycle
- A. is at rest.
 - B. is speeding up.
 - C. is slowing down.
 - D. has a constant speed.

MC#: 18

Key: B

Learning Results: I-2

Motion

- 1 Students will understand the motion of objects and how forces can change that motion. Students will be able to
- 2 use mathematics to describe the motion of objects (e.g., speed, distance, time, acceleration).

19. In which example are offspring produced that are identical to the parent through asexual reproduction?
- A. A female frog lays eggs in the water. The male later fertilizes the eggs.
 - B. A pollen cell and an egg cell from the same flower join to become a seed.
 - C. A bud breaks off a yeast cell and becomes a new yeast cell.
 - D. A sea star breaks off a leg and a new leg grows back.

MC#: 19

Key: C

Learning Results: D-4

Continuity and Change

- D Students will understand the basis for all life and that all living things change over time. Students will be able to
- 4 compare how sexually and asexually reproducing species transfer genetic information to offspring.

20. Scientists compare layers of rock to each other in order to determine the
- A. relative age of rocks.
 - B. composition of rocks.
 - C. amount of fossils in rocks.
 - D. chemical composition of rocks.

MC#: 20

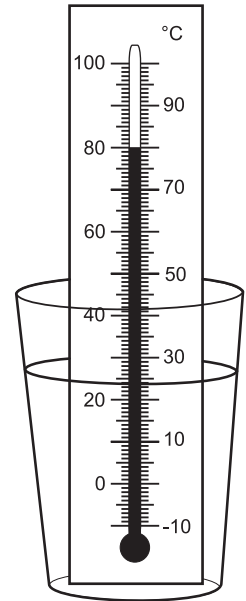
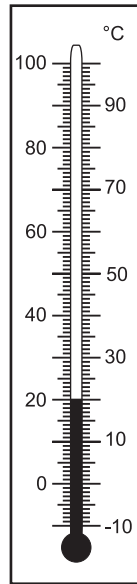
Key: A

Learning Results: F-3

The Earth

F Students will gain knowledge about the earth and the processes that change it. Students will be able to
3 explain the evidence scientists use when they give the age of the earth.

21. A thermometer at 20°C is placed in hot water. The column of liquid in the thermometer rises.
- What is the temperature reading on the thermometer in the hot water?
 - Explain what happens to the molecules of the liquid inside the thermometer when the thermometer is put into the hot water. Use the word “molecules” in your answer.



CR#: 21

Learning Results: H-6

Energy

- H Students will understand concepts of energy. Students will be able to
- 6 describe how energy put into or taken out of a system can cause changes in the motion of particles in matter.

CONSTRUCTED-RESPONSE SCORING GUIDE

Score	Description
4	Response demonstrates an in-depth understanding of how energy put into or taken out of a system can cause changes in the motion of particles in matter. Student correctly reads the thermometer and correctly explains what happens to the molecules of the liquid inside the thermometer when the thermometer is put into the hot water.
3	Response demonstrates a general understanding of how energy put into or taken out of a system can cause changes in the motion of particles in matter. Student correctly reads the thermometer and generally explains what happens to the molecules of the liquid inside the thermometer when the thermometer is put into the hot water.
2	Response demonstrates a limited understanding of how energy put into or taken out of a system can cause changes in the motion of particles in matter. Student correctly reads the thermometer and partially explains what happens to the molecules of the liquid inside the thermometer when the thermometer is put into the hot water.
1	Response demonstrates minimal understanding of how energy put into or taken out of a system can cause changes in the motion of particles in matter. Student correctly reads the thermometer or minimally explains what happens to the molecules of the liquid inside the thermometer when the thermometer is put into the hot water.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Training Notes for Constructed-Response #21

Score	Description
4	Student gives a temperature reading of 80°C and explains, using the word molecules, what is happening to the liquid inside the thermometer when it is put into the hot water. Response is well developed and contains no errors.
3	Student gives a temperature reading of 80°C and explains, using the word molecules, what is happening to the liquid inside the thermometer when it is put into the hot water. Response is general and contains minor errors.
2	Student gives a temperature reading of 80°C and explains what is happening to the liquid inside the thermometer when it is put into the hot water. Response lacks detail and contains errors. OR Student gives a temperature reading with the wrong unit and generally explains what is happening to the liquid inside the thermometer when it is put into the hot water. Response is partial and contains errors.
1	Student gives a temperature reading of 80°C. Response may contain a minor error. OR Student response explains what is happening to the liquid inside the thermometer when it is put into the hot water. Response is minimal and contains errors.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Correct answers:

Part a: 80°C—minor error if “°C” is missing.

Part b: the liquid molecules absorb energy from the hot water and begin to speed up causing the liquid to expand (take up more space) in the narrow tube

21.

4

a) the temperature reading on the thermometer is 80°C or 80 degrees Celcius.

b) The molecules of the thermometers liquid are heated when placed in hot water. the heat causes the molecules to get farther apart and move faster, expanding the liquid. in the small thermomete the liquid expands and goes up.

21.

4

A. the temperature reading is 80°C .
 B. Heat make molecules move faster causing more collisions. So when the thermometer is placed in the heated water, because the molecules are moving so fast and colliding, the only space for them to move is up. Thus making the mercury in the thermometer rise.

21.

3

The temperature reading on the thermometer is 80°C . This all happens because of the heat expanding the mercury. The heat in the water excites the mercury in the tube. The molecules expand and rise up the tube (the only way to expand). The hotter the water is, the more excited the mercury gets the higher it has to rise up the tube.

21.

3

A) The temperature reading is 80°C with the thermometer in hot water. B) When the molecules in the thermometer come in contact with heat they move very quickly and spread out causing the top of the liquid to rise. The more heat that the molecules contact the faster they move, and vice-versa.

21.

2

42. A: The temperature reading is 80°C in the glass.

D: When the thermometer is placed in the water, the molecules will move around very quickly.

21.

2

Ⓐ it is read 80°C
Ⓑ the molecules expand and rise up the thin glass tube

21.

1

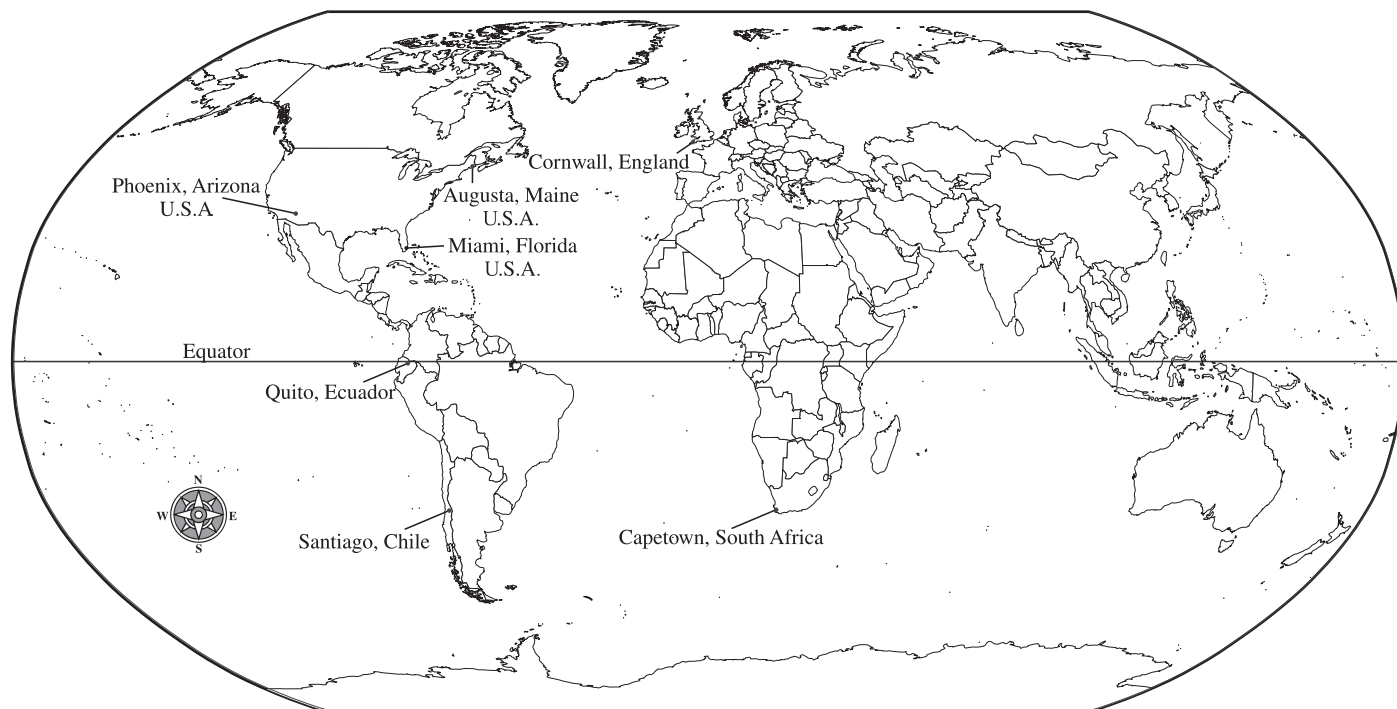
a. 80°C b. The molecules get very hot quickly.

21.

1

A) 80°C
B) I never learned what happens to the molecules in a thermometer, and I have no clue.

Locations of Schools Receiving NASA Bean Seeds



Location	# of Days
Miami, Florida, U.S.A.	5
Quito, Ecuador	5
Cornwall, England	6
Augusta, Maine, U.S.A.	8
Phoenix, Arizona, U.S.A.	9
Capetown, South Africa	11
Santiago, Chile	12

22. The National Aeronautics and Space Administration (NASA) gave bean seeds that had been on the space shuttle for three weeks to schools in different countries around the world. The schools were asked to determine the average germination time (the time it takes for the seeds to sprout) under natural, outdoor conditions. The schools then shared their data over the Internet. The table above shows what each school found.

Give **three** possible reasons for the differences in the data.

CR#: 22

Learning Results: J-4

Inquiry and Problem Solving

J Students will apply inquiry and problem-solving approaches in science and technology. Students will be able to

4 compare and contrast the processes of scientific inquiry and the technological method.

CONSTRUCTED-RESPONSE SCORING GUIDE

Score	Description
4	Response demonstrates an in-depth understanding of comparing the processes of scientific inquiry. Student gives strong logical reasons for the differences in the data.
3	Response demonstrates a general understanding of comparing the processes of scientific inquiry. Student gives generally logical reasons for the differences in the data.
2	Response demonstrates a simplistic understanding of comparing the processes of scientific inquiry. Student gives partially logical reasons for the differences in the data.
1	Response demonstrates a minimal understanding of comparing the processes of scientific inquiry. Student gives minimally logical reasons for the differences in the data.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Training Notes for Constructed-Response #22

Score	Description
4	Student gives three very coherent reasons why there is a difference in the data. Response is well developed and contains no errors.
3	Student gives three generally coherent reasons why there is a difference in the data. Response is general and may contain an error.
2	Student gives two or three reasons, lacking coherence of why there is a difference in the data. Response is limited and contains errors.
1	Student gives one or two reasons with little coherence of why there is a difference in the data. Response is minimal and contains errors.

Possible answers:

- different seasons of the year (2 hemispheres)
- different soil temperatures, depending on location
- different types of soils
- experimenters may have used different planting methods
- lengths of day different
- experimenters may have differed in deciding when the seed germinated (just beginning to emerge or fully sprouted)
- experimenters may have planted seeds at different depths
- different amounts of rain
- angle of the Sun's rays to the surface of Earth—different amount of sunlight

22.

4

1st of all, there could have been differences in soil type - the soil near Miami, Florida, U.S.A., could have been a good deal more fertile than that of Santiago, Chile. Also, the temperature of that area and the amount of rain it received on a regular basis could also have something to do with the germination time. You see, in Capetown, South Africa, rains are less frequent than they are in, let's say, Cornwall, England. And the same is probably true for Santiago, Chile. It's good for plants to have a little sunlight, too, but if there's too much sunlight & too little water, then the plant's germination time is going to increase - I think this is why the time is greater for those 2 far-south cities in Chile & South Africa.

Depending on the temperature, amount of water they were given, and the amount of light they received, the plants could have turned out with very different results. In England, most likely the plants wouldn't have received as much sun^(light) as Quito, Ecuador, for example. It's a lot hotter in Ecuador than in England. The plants in Ecuador would have received more rain than in Phoenix, Arizona. It rains almost every day in Ecuador for short periods of time and in Phoenix, it's quite warm and sunny, therefore the bean seeds would receive as much water. Bean seeds would do better in Florida's temperatures than in Maine temperatures. The Florida temperatures are on average, warmer and more consistent. All of these are factors that reasoned in on the differences.

One reason for a difference in the data is the less rain they get the longer it takes. Places like Africa where its really hot and don't get a lot of rain could make it take longer to sprout. Another reason could be temperature, where there is average humidity like Florida and Ecuador where the temperature is just right would make it grow faster. The last reason for the possible differences in data is the soil. The desert like Phoenix, Arizona, isn't a great place to grow something along with Africa where it is very dry and so is the soil.

My first reason for the difference is the location in comparison to the equator. The closer it was to the equator the faster it sprouted. The temperature could be another reason because, the warmer the climate, the faster they sprouted. My third reason could be the soil. Since Augusta Maine and Santiago Chile are about the same distance from the equator but the seeds in Maine sprouted four days earlier so it would probably have something to do with the soil the seeds were grown in.

Well Miami, Florida and Quito, Ecuador took the least amount of time because it rains and they have plenty of sun. In Augusta, Maine it took a little longer because even though it rains and they have sun it's a lot cooler there. Phoenix, Arizona took longer because even though it is hot and sunny there it is also dry because they don't get as much rain as some other places do.

The climate is one thing, here in Maine where it's cold it would take longer for a plant to grow, in Florida it would grow faster. And if it was around winter time than I'd be surprised if it grew at all, but in Florida where it's always warm it would still grow. Another is the current temperature in general, in Ecuador where it's right on the equator it will grow quicker because it's warm. But maybe in Chile where it's probably 10° it might grow slower.

22.

1

The weather could have been nice in one place and they grew quick or bad weather made it hard for them to grow.

2) Some of the seeds might have been better than the other ones.

3) Soil could have been better in one place than it was in the other.

22.

1

1. the difference in climate (temp, weather)
2. The differences in soil and ground quality
3. Rain differences and other weather effects growth.

23. Humans have been observing stars for thousands of years.

- a. List **two** things we know about stars today that we did not know 200 years ago.
- b. Describe **two** ways scientists gather information about stars today that were not possible 200 years ago.

CR#: 23

Learning Results: G-1

The Universe

- G Students will gain knowledge about the universe and how humans have learned about it, and about the principles upon which it operates. Students will be able to
- 1 compare past and present knowledge about characteristics of stars (e.g., composition, location, life-cycles) and explain how people have learned about them.

CONSTRUCTED-RESPONSE SCORING GUIDE

Score	Description
4	Response demonstrates an in-depth knowledge of stars and how information is gathered. Student correctly lists things known about stars today and correctly describes ways scientists gather information today.
3	Response demonstrates a general knowledge of stars and how information is gathered. Student correctly lists things known about stars today and broadly describes ways scientists gather information today.
2	Response demonstrates a limited knowledge of stars and how information is gathered. Student lists things known about stars today and partially describes ways scientists gather information today.
1	Response demonstrates a minimal knowledge of stars and how information is gathered. Student lists things known about stars today and minimally describes ways scientists gather information today.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Training Notes for Constructed-Response #23

Score	Description
4	Student correctly lists two things we know about stars today that were not known two hundred years ago and correctly describes two ways scientists gather information about stars today that were not possible two hundred years ago. Response is well developed and contains no errors.
3	Student lists two things we know about stars today that were not known two hundred years ago and describes two ways scientists gather information about stars today that were not possible two hundred years ago. Response is general and may contain an error.
2	<p>Student lists two things we know about stars today that were not known two hundred years ago and describes one way scientists gather information about stars today that was not possible two hundred years ago. Response lacks detail and contains errors.</p> <p>OR</p> <p>Student lists one thing we know about stars today that was not known two hundred years ago and describes two ways scientists gather information about stars today that were not possible two hundred years ago. Response lacks detail and contains errors.</p>
1	<p>Student lists one thing we know about stars today that was not known two hundred years ago and/or describes one way scientists gather information about stars today that was not possible two hundred years ago. Response is minimal and contains errors.</p> <p>OR</p> <p>Student lists one thing we know about stars today that was not known in the past and/or describes one way scientists gather information about stars today that was not possible in the past. Response is minimal and contains errors.</p>

Part a

- distance of stars from Earth
- size of stars
- composition of stars
- temperature of stars
- motion of stars—moving toward or away from Earth

Part b

- large refracting and reflecting Earth-bound telescopes
- infrared and ultraviolet telescopes
- radio telescopes
- orbiting telescope (Hubble telescope)
- computer analysis of star photographs
- space probes

23.

4

a. We know that stars have many phases and different lengths of life. We also know that different sized stars act differently and form a varying array of things when their lives end. These things can range from supernovas to black holes. They also know the age of our star the Sun.

b. They can use radio waves. They use them by using large dishes to scan the skies for frequencies and noises. These help a scientist know whats out there. Now they can also use spaceships to help them. They even have telescopes in space that give them a clearer view and more accurate data.

a - Two things we know about stars today that wasn't known two hundred years ago are they are made of flaming gases and they are millions upon millions of light years away, not just little dots in our solar system.

b - Scientists use a lot of new ways to gather information about stars. One way is sending cameras in satellites and gathering the photographs and putting them together down here.

Another way of observing and gathering is through high powered telescopes, now they have computers to help with long information they can electronically focus the lens and see a lot farther.

A. Two things that we know about stars today unlike 200 years ago are how long a star "lives" and the temperature of each star.

B. Two ways that scientists gather this new information are as follows. The first way is the use of space probes. These probes relay information back to Earth on the various stars. The second way is the improved use of technology. Unlike 200 years ago, telescopes are more powerful than ever before, allowing for a better judgement on information.

A) Two things we know about stars now are what they are made of and their life cycle information

B) In this age scientists can gather information about stars by sending up satellites to take pictures. These pictures can be used to study behavioral and physical characteristics of stars. Scientists also can use powerful telescopes to study the stars. These are very accurate and can tell the scientist much about a star's place in the universe.

23.

2

Today we know that the earth is not the center of the universe and we know that there are other galaxies.

One way we gather information now is a high powered telescope or satellite and another way is to send up a ship.

23.

2

A. We know more about what they're made of and how they develop and die. 200 years ago we didn't have much information on them at all. We only knew they were there.

B. We send satellites out to observe them and 200 years ago we didn't have satellites. They also have really powerful microscopes so they can see them better, where 200 years ago they only had simple microscopes.

23.

1

A) they are little balls of fire with gas. They are billions miles away.

B) They use telescopes and charts.

23.

1

That it has a black hole, the sun is a star
Big microscopes, Sattelites stuff like that

24. Discuss, in detail, **two** changes that were made in cities after the discovery that microorganisms caused disease.

CR#: 24

Learning Results: M-2

Implications of Science and Technology

- M Students will understand the historical, social, economic, environmental, and ethical implications of science and technology. Students will be able to
- 2 describe the historical and cultural conditions at the time of an invention or discovery, and analyze the societal impacts of that invention.

CONSTRUCTED-RESPONSE SCORING GUIDE

Score	Description
4	Response demonstrates an in-depth understanding of cultural conditions at the time microorganisms were discovered to cause disease and the impacts of that discovery. Student discusses in detail two changes that were made.
3	Response demonstrates a general understanding of cultural conditions at the time microorganisms were discovered to cause disease and the impacts of that discovery. Student broadly discusses two changes that were made.
2	Response demonstrates a simplistic understanding of cultural conditions at the time microorganisms were discovered to cause disease and the impacts of that discovery. Student partially discusses two changes that were made.
1	Response demonstrates a minimal understanding of cultural conditions at the time microorganisms were discovered to cause disease and the impacts of that discovery. Student minimally discusses two changes that were made.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Training Notes for Constructed-Response #24

Score	Description
4	Student discusses in detail two changes made in cities after the discovery that microorganisms caused disease. Response is well developed and contains no errors.
3	Student discusses two changes made in cities after the discovery that microorganisms caused disease. Response contains minor errors.
2	Student discusses two changes made in cities after the discovery that microorganisms caused disease. Response is weak and contains errors.
1	Student discusses two changes made in cities after the discovery that microorganisms caused disease. Response is minimal and contains errors.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.

Possible answers:

- reduction of rat population/using rat poison or cats
- treatment of wastewater
- introduction of septic systems and better ways to reduce untreated sewage-contaminated water supplies
- isolation of patients with communicable diseases in hospitals
- chlorination of water or treatment of water
- improved personal hygiene

24.

4

After it was discovered that microorganisms caused disease, cities tried to make public places more sanitary. In hospitals, surgeons made sure that they wore gloves and "scrubbed down" fiercely before and after the operation. On the streets, trash collectors were much more careful handling the garbage, trying to wear gloves and making sure they removed trash from an area cleanly and efficiently. City employees, too, would be drilled in case of a plague or epidemic. Of course, cities are still nowhere near becoming germ-proof – but they're working on it.

One of the major changes was disinfection. Now that we know there are minute things in our cities we have come out with many products that kill these invisible to the eye microorganisms. We have disinfectant cleaners, sprays, soaps, and many other products that we use today.

Another thing that we have come out with is taking care of things like our trash. Studies found that small, microorganisms seem to grow and become more populated in trash. Now we have trash trucks, trash cans, and dumps made just for trash. We also have sterilized hospitals.

One change that was made in cities after the discovery that microorganisms caused disease was that the city water was cleaned up. City officials realized that if they didn't purify the drinking water, much of their population would die. Another adjustment that was made after this discovery was that city officials often scheduled inspections of restaurants, to make sure that the conditions were clean, and no microorganisms were getting into the food.

When people discovered that microorganisms caused disease one thing people did was keep cities much cleaner. Before there had always been very dirty roads and buildings but then they tried to clean it up. They no longer threw garbage outside, they collected it and put it in garbage dumps. Another thing people did was they tried to kill off all the rats, which could carry microorganisms onto people. They did this by buying many cats.

Two changes were made when scientists (or common people) discovered that microorganisms caused disease. One was that everyone had to get injections or vaccinations to prevent these little disease causing bacteria from making them sick. A second change that was made: Every family had to make sure that their food and everything they contacted with their body was clean.

the people probably got vaccine shots, if they wanted them, + sterilization period probably went on for a while to kill the organisms or to find what the disease was and how to make a vaccine for it, to become immune to it.

24.

1

Two changes were that they made new chemicals that kill these bugs and they came up with new medicines to fight the disease that was spreading. They also cleaned the cities up more and tried to find out where these bugs come from and how to stop them.

24.

1

One would be we stoped
Throughing garbeg on the streets.
Also we heept garbeg in containers
like trash cans

25. Which item does **not** come from a material in Earth's crust?

A.



Clay pot

B.



Tin can

C.



Metal spoon

D.



Wool sweater

MC#: 25

Key: D

Learning Results: F-6

The Earth

F Students will gain knowledge about the earth and the processes that change it. Students will be able to
6 describe the many products used by humans that are derived from materials in the earth's crust.

26. Disease caused by microorganisms **cannot** be spread by
- A. exposure through air or water.
 - B. mutation of genes.
 - C. direct contact with animals.
 - D. direct contact with an infected person.

MC#: 26

Key: B

Learning Results: C-4

Cells

- C Students will understand that cells are the basic units of life. Students will be able to
- 4 identify the causes and effects of diseases, explain their transmission, and identify prevention strategies.

27. Fossils of the fern *Glossopteris* have been found in Africa, Australia, Antarctica, and South America. How do scientists explain this observation?
- A. The wind blew the seeds across the oceans from continent to continent.
 - B. The fern developed independently on each continent.
 - C. The continents were at one time joined together and then moved apart.
 - D. The fern had adaptations to survive the different environments of the continents.

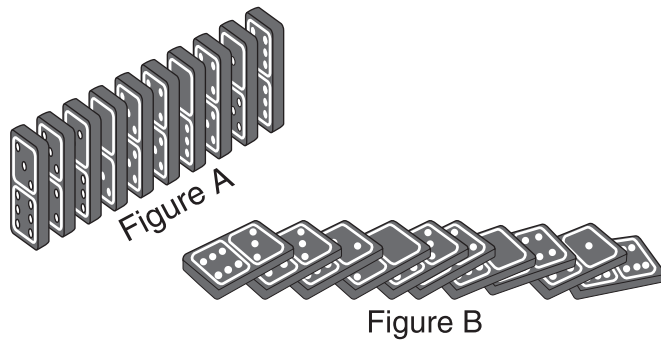
MC#: 27

Key: C

Learning Results: D-2

Continuity and Change

- D Students will understand the basis for all life and that all living things change over time. Students will be able to
- 2 explain how scientists use fossils to prove that life forms, climate, environment, and geologic features in a certain location are not the same now as they were in the past.



28. Suppose there were ten dominos standing in a row (Figure A) with a space between them smaller than the length of a domino. What would be the **direction** of a force used to make the dominos fall from left to right as in Figure B?
- A. The force would be in the same direction as the motion.
 - B. The force would be from the side.
 - C. The force would be in the opposite direction to the motion.
 - D. The force would be from above.

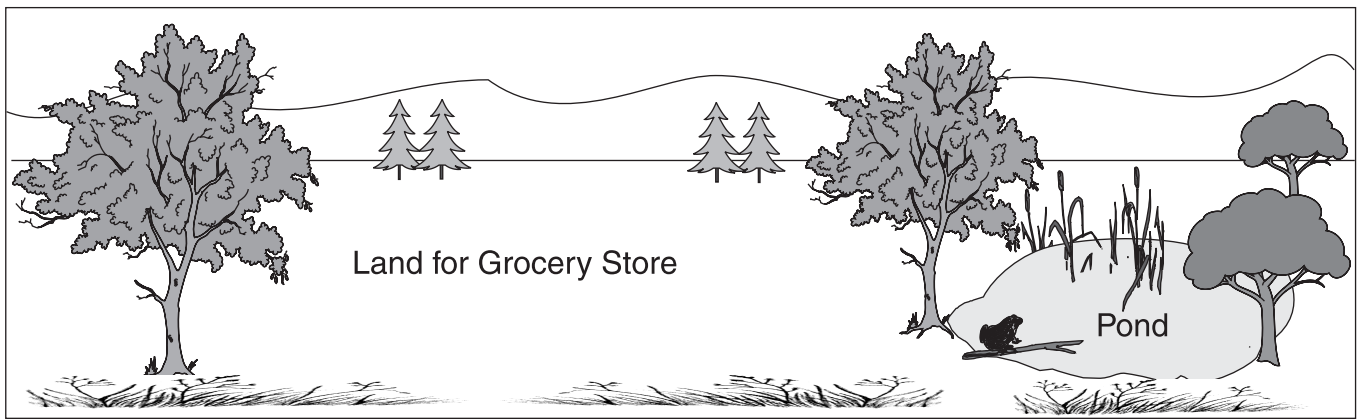
MC#: 28

Key: A

Learning Results: I-1

Motion

- I Students will understand the motion of objects and how forces can change that motion. Students will be able to
- 1 describe the motion of objects using knowledge of Newton's Laws.



40. Favorite Food Grocery plans to build a new store on land beside a pond. Explain **three** ways this development could impact the life cycle of frogs in the pond.

CR#: 40

Learning Results: M-4

Implications of Science and Technology

- M Students will understand the historical, social, economic, environmental, and ethical implications of science and technology. Students will be able to
- 4 describe an individual's biological and other impacts on an environmental system.

CONSTRUCTED-RESPONSE SCORING GUIDE

Score	Description
4	Response demonstrates an in-depth understanding of how human beings can impact an environmental system. Student correctly explains the impact of new construction on the life cycle of frogs in a nearby pond.
3	Response demonstrates a general understanding of how human beings can impact an environmental system. Student broadly explains the impact of new construction on the life cycle of frogs in a nearby pond.
2	Response demonstrates a simplistic understanding of how human beings can impact an environmental system. Student partially explains the impact of new construction on the life cycle of frogs in a nearby pond.
1	Response demonstrates a minimal understanding of how human beings can impact an environmental system. Student minimally explains the impact of new construction on the life cycle of frogs in a nearby pond.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Training Notes for Constructed-Response #40

Score	Description
4	Student correctly explains three impacts on the life cycle of frogs created by the grocery store being built nearby. Response is well developed and contains no errors.
3	Student broadly explains three impacts on the life cycle of frogs created by the grocery store being built nearby. Response is general and may contain an error.
2	Student simplistically or partially explains three impacts on the life cycle of frogs created by the grocery store being built nearby. Response is limited and contains errors.
1	Student minimally explains three impacts on the life cycle of frogs created by the grocery store being built nearby. Response is minimal and contains errors.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Possible answers:

- possible reduction in number of some insects that are part of the food supply for frogs/tadpoles
- reduction in the ecosystem that supports the food chain for the pond organisms (frogs/tadpoles)
- increase in temperature of pond due to pavement in parking lot (pavement absorbs heat during the spring and summer months and loses some of its heat to the pond which is cooler), which in turn kills tadpoles in the spring and adult frogs in the summer or may reduce the amount of water in the pond by causing evaporation
- pollution from cars kills some of the frogs and/or tadpoles by dissolving in the pond water, or pollutes the air over the pond
- construction materials could get into the pond, causing pollution and thereby interrupting food chains

Note: There needs to be a connection between development and impact on the life cycle of frogs in the pond.

40.

4

The Favorite food Grocer Store will screw up the life cycle of the frogs. The noise of the construction will drive the frogs into the pond and they will not want to get out to mate and capture food. With people comes trash that will pollute the pond and making it harder for frogs to live. They can get stuck in cups and die. In winter they will put salt and other chemicals on the parking lot. When spring comes with rain; all those chemicals will wash off into the pond. The salt and chemicals will probably kill the frogs.

THE life cycle of a frog would be greatly impacted if Favorite Food Grocery builds a new store beside the pond in which the frog survives in. The water of the pond would become polluted and dirty, because there would be waste from the store and parking lots drifting into it. This would impact the frogs and make the population smaller because tadpoles live in the water. The insects that the frogs eat would become less because they would be attracted to the humans and light, and would move their location and be killed by annoyed humans. The frogs would then become even less because there would be less to eat. Also, the areas in which frogs hide from predators would be destroyed, making the frogs more vulnerable for attack and decreasing the population further. In short, these frogs are in trouble!

Gasoline and other harmful substances from vehicles can get in the pond and can kill the frogs.

Garbage will probably end up in the pond and the frogs can get tangled in it.

If the frogs are wondering around and they end up in the parking lot they could get run over by a car.

All of these things have a negative effect on the life of the frog.

Building buildings near ponds or streams will always hurt the wildlife there. Because people loiter, especially near urban areas the pond could get polluted. Even during the construction of the building, construction workers could spill things into the pond that may poison the frogs. The worst thing that could happen though, is if the pond was just drained to put in a parking lot. The frogs would then have no where to live and would eventually die.

40.

2

One way that it could effect the Frogs is by, if you are trying to park a car then you might run over one.

Another way is when you are building the store the dust and trash from the process of making the buiding could go in the pond and pollute the water.

Lastly, people might throw their trash in the pond and the frogs might get caught in the trash.

40.

2

The life cycle of a frog requires a very marshy environment. If there was to be a parking lot, water could flow off the pavement and flood the pond. Also when it floods, whatever waste that is on the tar, like rock salt, will be put into the water. A frog's skin absorbs water, so this could severely mutate the creature. Frogs do not spend all their time in water. If the area is developed, there could be quite a few issues with cars running over frogs.

40.

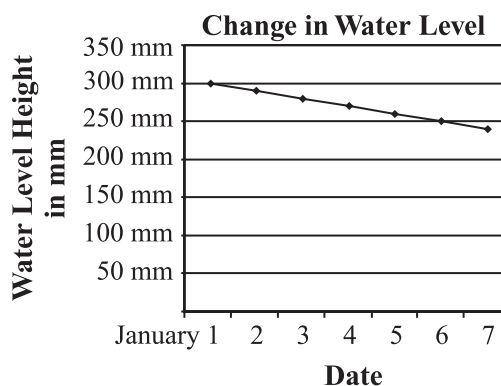
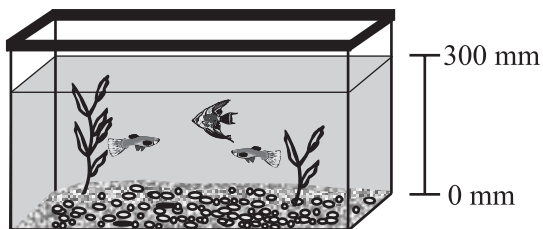
1

The Grocery store pollutes the air and the frogs will get sick. stuff that leaks can put deformities on frogs. The Pond would get polluted and the frogs would have nowhere to go.

40.

1

If they do build next to the pond the frogs will probably leave because of the noise & comotion. Either that or they'll come & invade the store by getting inside when the doors are opened. & by that happening the store would probably close down.



41. Using scientific terminology, explain the change in the water level and describe the motion of the water molecules during that change.

CR#: 41

Learning Results: E-5

Structure of Matter

- E Students will understand the structure of matter and the changes it can undergo. Students will be able to
 5 describe how the motion of the particles of matter determines the state of that matter (e.g., solid, liquid, gas, plasma) and vice versa.

CONSTRUCTED-RESPONSE SCORING GUIDE

Score	Description
4	Response demonstrates an in-depth knowledge of how the motion of particles of matter determines the state of that matter. Student correctly explains the changes in the water level and the motion of the water molecules during that change, using scientific terminology.
3	Response demonstrates a general knowledge of how the motion of particles of matter determines the state of that matter. Student generally explains the changes in the water level and the motion of the water molecules during that change, using scientific terminology.
2	Response demonstrates limited knowledge of how the motion of particles of matter determines the state of that matter. Student partially explains the changes in the water level and the motion of the water molecules during that change.
1	Response demonstrates minimal knowledge of how the motion of particles of matter determines the state of that matter. Student minimally explains the changes in the water level or the motion of the water molecules during that change.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Training Notes for Constructed-Response #41

Score	Description
4	Student explains using scientific terminology the change in the water level and the motion of the water molecules, as influenced by anything in the environment. Response is well developed and contains no errors.
3	Student explains using general terminology the change in the water level and the motion of the water molecules, as influenced by anything in the environment. Response contains minor errors.
2	Student explains using general terminology the change in the water level and the motion of the water molecules, as influenced by anything in the environment. Response lacks detail and contains errors.
1	Student minimally explains the change in the water level or the motion of the water molecules, as influenced by anything in the environment. Response contains errors.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.

Possible answers:

Students should be able to describe why evaporation occurs in terms of water molecules at the surface moving and escaping into the air.

Humans—add water to the aquarium when the water level drops

Sun—heats up the water molecules giving them energy to escape the surface of the water

Fish—have a negligible effect

Plants—photosynthesis would use a small amount of water

Air—low humidity would allow more water molecules to escape

Temperature—as the temperature increases the water molecules gain energy and escape from the tank more easily

41.

4

The water molecules move some in the change in the water level in the tank. The water level keeps dropping because of evaporation. Evaporation is when a liquid turns into a gas under the boiling point. This happens very slowly. The water in the fish tank is slowly being evaporated because the water molecules are constantly moving. This is called the kinetic theory. When the molecules move fast enough, they are evaporated. As the molecules move just a little faster every minute, they move a little, tiny bit farther apart. When they are far enough apart, they separate completely, evaporating into the air around us. That's why the water level changes and what happens to the molecules.

by analysis, I've realized the water level drops 50 mm every 6 days, or about 8 mm per day. The level could change by increase in temp., in which case the water molecules would be moving at a greater speed as the water evaporates. This is such because liquid has a definite volume, but no definite shape, and the molecules slide past one another. Gas has more energy, and no definite shape or volume. The molecules are also moving much quicker and more freely, as a liquid heats from sunlight, it turns to gas (evaporation) and then the molecules move much quicker.

41.

3

As days went by, it may have gotten hotter, causing the water molecules to have more energy. That caused them to move faster and go farther apart, and then, the water evaporates. Gas, is less dense, a result of the molecules spreading apart after heat was applied. So, everyday, more and more water evaporated causing the water level to go down from 300mm to about 240mm over the course of seven days.

41.

3

The water level dropped a little more than 50mm. What happened was the water evaporate. What happens when something evaporate is, the particles move around so fast and bounce off each other into the air, so the water level decreases because this keeps repeating.

41.

2

The change in the water level is due to evaporation. When water heats up, it changes its state of matter from a liquid to a gas. Through these seven days the temperature of the room that this tank was in must have increased. When the temperature increased the molecules of the water in the tank would have increased their speed of movement. The molecules changed form and now they are a gas.

41.

2

During this time period the water level drops a little each day. The reason for the water level dropping is because the water is evaporating into the air. As the water starts to heat up inside the molecules start to move faster and turn into water vapor that goes into the air that we breathe everyday.

41.

1

The water is being evaporated.
There is no cover so the liquid molecules spread out and are evaporated into the air.

41.

1

The water in the fish tank will evaporate after a while. The molecules change from a liquid to a gas.